REMARKS

Claims 1, 6, 7, 10, 11, 13-16 and 18-19, 23-25, 28-29 and 32-34 are pending.

Claims 2-5, 8, 9, 12, 17, 20-22, 26-27 and 30-31 have been cancelled without prejudice or disclaimer.

I. Claim Amendments

Claim 1 was amended to recite the subject matter of each of (now cancelled) claims 3-5, 8, 9, 12 and 17.

Claim 1 was also amended to change "shaping or forming" to "forming". It is respectfully submitted the term "or forming" was superfluous.

New claims 33 and 34 depend from claim 1 and are supported in the present specification at page 5, lines 14-17. No new matter has been added.

II. 35 USC § 102

Claims 1, 2 and 27 stand rejected under 35 USC § 102(b) as being anticipated by Anton (U.S. Patent No. 5,236,525). However, in light of the amendments to claim 1, from which each of claims 2 and 27 depend, reconsideration is respectfully requested.

Specifically, none of claims 3-5, 8, 9, 12 and 17 were included in this rejection, and claim 1 now recites the subject matter of these claims. Thus, Applicants respectfully submit Anton does not anticipate the present claims.

Moreover, the present claims recite "providing an aluminum alloy *plate*" (emphasis added). In contrast, Anton refers to "aluminum alloy *sheet* metal parts." As is known to those of ordinary skill in the art, sheet products and plate products are mutually exclusive, depending upon their thickness (See Section III.B, below). Thus, since Anton neither teaches nor suggests processing *plate* materials, Applicants respectfully present this reference does not teach or suggest each feature of the rejected claims.

III. 35 USC § 103

A. Claim 4

Claim 4 stands rejected under 35 USC § 103(a) as allegedly being unpatentable over Anton. However, as claim 4 has been cancelled, Applicants respectfully present this rejection is moot.

B. Claims 3, 5-10 and 12-17

Claims 3, 5-10 and 12-17 stand rejected under 35 USC § 103(a) as allegedly being unpatentable over Anton in view of Applicant's alleged Admitted Prior Art (AAPA).

1. Anton Has A number of Deficiencies

Anton discloses a method of optimizing the tensile strength of a structure formed by superplastically formed aluminium-lithium materials, and whereby the structure immediately following the process of superplastic forming is quenched, and the quenched structure is then artificially aged to achieve a tensile strength of at least 50 ksi (see, e.g., claim 1). The aluminium-lithium alloy of Anton is of the 2090 or 8090 series alloys (see column 2, line 54).

The problem solved by this method is that it avoids the need for a solution heat treatment which is said to be accountable for significant solute depletion resulting in higher density for the alloys and loss in maximum achievable strength (see column 2, line 30-37).

In column 3, line 50 and column 4, line 5 reference is made to sheets. According to aluminum standards and data as known in the art and as published by the Aluminum Association, "sheet" is a rolled product rectangular in cross section and having a thickness of at least 0.15 mm and less than 6.3 mm in thickness with sheared, slit, or sawed edges. In contrast, "plate" is defined as having a thickness of greater than 6.3 mm. "Aluminum Association | -Sheet, Plate" (provided as an Attachment hereto).

Should the aluminium-lithium sheet product disclosed by Anton be used in an aerospace structure such as an aircraft fuselage, it would still require the connection of stringers or beams to the sheet by riveting or welding. This is avoided by the claimed invention.

The invention as currently claimed provides a method of manufacturing an integrated monolithic aluminium structure being part of a wing skin or a frame portion for an aircraft, the aluminium structure being made from AA5xxx, AA6xxx or AA7xxx-series aluminium alloy. The method involves two distinct heat treatments, one heat treatment carried out prior to shaping,

preferably the shaping is by means of bending, and a second heat treatment after shaping, and after which the integrated monolithic aluminium structure is machined from the shaped structure.

The problem addressed by the claimed invention is distinct from the one solved by Anton. While the presently claimed invention reduces, *inter alia,* the distortion of a machined product being part of a wing skin or a frame portion for an aircraft, Anton is fully silent about machining the products.

Furthermore, the present claims recite the use of aluminum alloys of the AA5xxx, AA6xxx and AA7xxx-series alloys which are distinct alloys compared to the aluminum-lithium alloys, more in particular the 2090 and 8090 alloys, as disclosed by Anton.

The presently claimed invention also has various significant advantages not suggested by either Anton or the alleged AAPA. As explained by the present specification at page 8, lines 8-19, an advantage of the present invention is that it uses less aluminum for machining or milling since the predetermined thickness y of the alloy plate 4 is considerably smaller than a predetermined thickness of the whole aluminum block. Furthermore, by an ageing step after the shaping, it is possible to obtain essentially distortion-free structural members suitable for, e.g., aircraft fuselage and wing applications. Another advantage of the method and the product of the present invention is that it provides a thinner final monolithic product or structure that has strength and weight advantages over thicker type products produced over conventional methods. This means that designs with thinner walls and less weight may be provided and approved for use. Yet another advantage of the method and the product of the present invention is the weight reduction of the monolithic part. Weight is further reduced also by the possible elimination of fasteners. This is related to the accuracy advantages in the machining operation resulting from the reduced distortion, and the inherent accuracy of final machining after forming.

2. <u>The alleged AAPA fails to Cure the Deficiencies of Anton</u>

The Office action asserted some of the dependent claims, now incorporated into claim 1, would have been obvious over Anton in view of AAPA. In particular, the Office action asserts that Anton does not disclose artificially aging the structure to a temper of T6, T79, T78, T77, T76, T74, T73, or T8, the AAPA teaches it is known to age structural components to such temper conditions.

It is respectfully submitted the alleged AAPA fails to cure any of the above-described deficiencies of Anton.

The AAPA explains it is known (and disclosed in the application in paragraph [008]) to age the plate forming to fuselage before the attachment or machining of the ribs. As set out in the application in paragraph [009] the bending and the machining results in considerable distortion. This is further illustrated in the Example in paragraph [0048], where the plate has been aged to a T351 temper prior to bending and is <u>not</u> (further) aged <u>after</u> being bent.

In contrast to the AAPA, the present invention ages <u>after</u> shaping. The present invention shapes, e.g., bends, a plate to form a curved or shaped structure, then the shaped structure is aged (e.g., preferred modes of ageing are recited by claims 2 and 3), and then if desired is it machined into an integrated monolithic structure (Claim 26 recites this machining). This present invention's ageing after shaping is in addition to other ageing that may have occurred before shaping.

The AAPA discloses two methods of prior art processing.

In a first method, the product is bent and stringers or beams are attached as discussed in paragraph [007]. The resulting product from this method has the disadvantage that, as explained at pages 2-3, paragraph [009] it displays considerable distortion after the bending and machining operation thereby showing a vertical and horizontal distortion which makes the assembly of the aircraft fuselage or aircraft wing cumbersome. As explained at page 8, paragraph [0042], "When the additional components 2 are attached to the base sheet 1 and when the whole structure is finished after the machining and riveting or welding step, a horizontal distortion d_1 and/or vertical distortion d_2 usually results from stress relief from the pre-curved plate or sheet which has been bent before additional components 2 are connected to the base sheet or before components 2 are machined from a plate product with a corresponding thickness." This stress release is not aging.

Stress relieving is different from aging because stress relieving involves heating a product for a short time period at low temperatures. Aging takes longer and is done in a controlled manner to achieve desired strength and corrosion resistance. In particular, artificial aging is

performed at higher temperatures than the stress relieving mentioned for the first method of the AAPA.

In a second method, a plate which has been previously heat treated and then bent and then a portion of the bent plate is machined away to form stringers and ribs and beams. As explained by paragraph [009] this bent and machined structure comprising sheet and stringers or beams displays residual or inner stress originating from such bending operation and results in regions with less or more internal stress. Those regions with an elevated level of internal stress tend to be more considerably susceptible to corrosion and fatigue crack propagation. As further explained at page 9, paragraph [0043], "A disadvantage with this approach is that there may be significant residual stress in the product, and this may lead amongst others to increasing the cross-section of frame members or the skin itself to meet required tolerances and safety requirements." As shown in the below-discussed example, the bent plate prior to machining suffers from distortion and residual stress. It is respectfully submitted that, after machining the bent plate to the desired shape, the residual stress remains.

Thus, the product of the first method suffers from distortion. Moreover, the product of the second method initially suffers from distortion and residual stress and, even after machining, suffers from residual stress. In contrast, the presently claimed product simultaneously avoids distortion and residual stress.

The significant reduction in distortion after machining while using the method according to the present claims is illustrated by the Example of the present specification. In particular, data at pages 9 and 10 of the present application shows the unexpected advantages of the present invention by comparing the following:

a product of the present invention, namely a plate in a T451 temper bent to a structure with a 1000 mm radius followed by artificial ageing to a T351 temper; with

a comparative product, namely a plate in the T351 temper bent to a structure with a 1000 mm radius and not further aged.

This comparative product is representative of a product processed according to the second prior art method, but not yet machined. The machining would not remove residual stresses in the metal remaining after machining.

The comparative product is also representative of a product processed according to the first prior art method because the distortion caused by bending a plate would also arise in the first prior art method which includes a plate bending step.

The data at paragraph [0048] shows the comparative example has a longitudinal distortion of 0.15 to 0.22 mm which can be calculated to a residual stress in the longitudinal direction of 49 to 54 MPa. In contrast, the distortion in the product of the present invention has a longitudinal distortion of 0.07 to 0.09 mm which can be calculated to a residual stress in the longitudinal direction of 16 to 22 MPa. This is unexpectedly lower.

3. It is improper to combine Anton with the alleged AAPA

The combination with the AAPA is not closing the "gap" between Anton and the subject matter recited by the present claims. As set out above, Anton addresses a different problem for different aluminum alloys. Furthermore, Anton relates to sheet products and the present claims relate to plate products.

Even if the AAPA were combined with the teaching of Anton it would not lead to the recited invention. According to Anton, the aluminum sheet product is immediately quenched following the process of superplastic forming. This clearly suggests superplastic forming is a process carried out at an elevated temperature, and column 3, line 61-62 mentions this superplastic forming is carried out at a temperature of 510°C.

In contrast, the shaping according to the present claims comprises cold forming. Thus, one of ordinary skill in the art would not be motivated to perform "quenching" following the recited process, as the shaped product is not at elevated temperature, and therefore cannot be quenched.

As a result, Applicants respectfully present that no *prima facie* case of obviousness has been made.

C. Claims 11 and 18

Claims 11 and 18 stand rejected under 35 USC § 103(a) as allegedly being unpatentable over Anton in view of Quist et al. (U.S. Patent No. 4,305,763). However, as Quist et al. also fails to cure the above-described deficiencies of Anton, reconsideration is respectfully requested.

D. Claims 19-26 and 28-32

Claims 19-26 and 28-32 stand rejected under 35 USC § 103(a) as allegedly being unpatentable over Anton in view of Bryans et al. (U.S. Patent No. 6,973,815). The Office Action asserts Anton teaches each step of the claims, except for the machining and resulting distortion (claims 19 and 26), and the component being used as part of an aircraft (claims 20-25), for which purpose Bryans et al. is cited.

Although the Office Action only lists claims 19-26 as being included in this rejection, a telephone conversation with the Examiner, on or about July 31, 2006, confirmed that claims 28-32 should have been included. Claim 28 now depends from Claim 1.

Initially, because Bryans et al. fails to cure the deficiencies of Anton alone, reconsideration of this rejection is respectfully requested.

VIII. Conclusion

In view of the above it is respectfully submitted that all objections and rejections are overcome. Thus, a Notice of Allowance is respectfully requested.

Respectfully submitted,

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ATTACHMENT – Aluminum Association | -Sheet, Plate

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Sheet and Plate

When aluminum is passed between rolls under pressure, it becomes thinner, and longer in the direction in which it is moving. This simple process is the basis for aluminum's most widely used forms: plate, sheet, and foil.

Aluminum can be flat-rolled and re-rolled until it reaches the desired thickness or gauge. Where the rolling process is stopped determines whether the final product will be plate (a quarter-inch thick or more), sheet (.249 to .006 inch), or foil (less than .006 inch).

The Production Process

Rolling begins with huge sheet ingots weighing as much as 20 tons, which have been preheated to make them easier to shape. As the size of rolling mills has increased, so has the size of these ingots, but a typical ingot is about six feet wide, 20 feet long, and more than two feet thick.

The ingot is first fed into a breakdown mill where it is rolled back and forth, reversing between the rolls until the thickness has been reduced to just a few inches. At this point, some plate is removed and readied for shipment. The plate is heat-treated and quickly cooled, or quenched, for added strength, and then stretched to straighten and to relieve internal stress built up during rolling and heat-treating. Finally, the plate is trimmed and aged at a desired temperature to develop its final properties.

Plate that is slated to become sheet or foil is trimmed after leaving the breakdown mill and sent through a continuous mill to further reduce thickness. Sheet thicknesses are then coiled.

To continue its reducing process, the coiled sheet is heated in a furnace to soften it for cold rolling. Cold rolling is the last step for some sheet, but other types, known as heat-treatable, are subjected to further elevated temperature processing, which increases the metal's strength.

Products and Applications

Plate is used in heavy-duty applications in the aerospace, machinery, and transportation markets.

Aluminum plate, machined to shape, forms the skins of jumbo jets and spacecraft fuel tanks. It is used for storage tanks and containers in many industries, and because aluminum is actually stronger at supercold temperatures, it is especially useful in holding cryogenic (very low temperature) materials.

Plate provides structural sections for rail cars and large ships, and armor protection for military vehicles and the trucks that carry the payroll.

Sheet, the most widely used form of aluminum, is found in all of the aluminum industry's major markets.

In packaging, sheet is used for cans and closures. In transportation, it provides panels for automobile bodies and for tractor trailer vehicles. Sheet is used in home appliances and cookware. In building and construction, it forms siding and gutters, down-sprouts and roofing, and awnings and carports.

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License plates and light bulb bases, pleasure boats and printing plates, highway signs and high flying planes are also all made of sheet.

Sheet can be color anodized to black or gold, red or blue, or hundreds of other colors. It can be etched to a "matte" finish or polished to a sparkling brightness and it can be textured to resemble wood or painted for lasting beauty.

{See also **Specialized Aluminum Products for Tool and Mold Applications**}[see also **Aluminum In Irrigation Systems**](see also **Aluminum Boats**){see also **Marine Market Support**}[see also **Visual Quality Characteristics**]

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